

Summary of Changes

to

P 421.1-1A R&D Safety Analysis and Review System

Revised Version Issued as P 421.1-1B of 3/27/03

FETC Procedure 421.1-1A, R&D Safety Analysis and Review System, of 10/1/99, has undergone many revisions. This Procedure has been rewritten to include the addition of Engineering Applications and Operations Division as part of the SARS process via hazards analysis, safety analysis review, and the annual ES&H assessment. Other changes include the addition of ISO 14001 requirements, the formal inclusion of “project specific safety analysis requirements,” “shakedown,” and “reviews and responses” sections in the safety analysis and the issuance of multiple permits for a single SARS package covering multiple locations. The name FETC has been replaced with NETL throughout the procedure. Please replace FETC Procedure 421.1-1A with NETL Procedure 421.1-1B.

U.S. Department of Energy

National Energy Technology Laboratory

PROCEDURE

P 421.1-1B

DATE: 3/27/03

SUBJECT: R&D SAFETY ANALYSIS AND REVIEW SYSTEM

1. PURPOSE. To describe the process and procedural requirements for a safety analysis and review of NETL's on-site R&D projects. The purpose of this safety analysis and review is to ensure that risks associated with NETL's on-site R&D projects are analyzed, understood, and eliminated, mitigated, or controlled to a degree acceptable by OST line management prior to potential adverse impacts on workers, the public, the environment, facilities, or equipment.
2. CANCELLATION. FETC Procedure 421.1-1A, R&D Safety Analysis and Review System, of 10/1/99.
3. REFERENCES.
 - a. NETL Order 420.3, Conduct of Operations.
 - b. NETL Order 421.1, Safety Analysis and Review System (SARS) at NETL.
 - c. NETL Order 450.1, Environmental Management System (EMS).
 - d. NETL Procedure 420.3-1, Operating Procedures and Operator Aids.
 - e. Referenced Forms:
 - (1) NETL F 421.1-1/1, Inspection Results.
 - (2) NETL F 421.1-2, R&D Safety Analysis Annual Assessment Form.
 - (3) NETL F 421.1-3, Document Control Cover Sheet Tier Levels 3 and 4.
 - (4) NETL F 421.1-4, Facility Authorization.
 - (5) NETL F 421.1-5, NETL Hazard Chart.
 - (6) NETL F 421.1-6, Industrial Hygiene Monitoring Requirements.
 - (7) NETL F 421.1-7, Project Specific Safety Analysis Requirements.

- (8) NETL F 421.1-8, [R&D Safety Analysis Cover Sheet and Signature Page](#).
 - (9) NETL F 421.1-9, [SARS Permit](#).
 - (10) NETL F 435.1-1, [Pollution Prevention and Waste/Resource Minimization Opportunity Assessment](#).
 - (11) NETL F 440.1-12/1, [PPE Hazard Assessment](#).
 - (12) NETL F 450.1-2, [Significant Environmental Impact Scoring Matrix](#).
 - (13) NETL F 450.1-4, [ISO 14001 Screening Analysis Questionnaire](#).
 - (14) NETL F 450.1-5, [Operational Training Form](#).
 - (15) NETL F 451.1-1/1, [Categorical Exclusion -- Appendix A or B of Subpart D DOE NEPA Implementing Procedures; 10 CFR Part 1021](#).
- f. Statutory ES&H Standards:
- (1) 29 CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals, current version.
- g. References:
- (1) DOE Handbook, "Chemical Process Hazards Analysis," DOE-HNDBK-110-96.
 - (2) NETL's Focused Standards List.
 - (3) NETL Research and Development Project Design Standard, current version.

4. DEFINITIONS.

- a. AD -- Associate Director.
- b. Administrative Control -- A *mitigation* method carried out through DOE or NETL directives and management practices (e.g., DOE orders, NETL procedures, *project* specific operating procedures, operations scheduling, etc.). Administrative controls are the second line of defense against *hazardous consequences* and are preferred over *safety instrumented* systems.
- c. Annual ES&H Assessment -- The yearly evaluation of all *SARS* permitted *projects* to ensure that no significant changes have been made to a *project* or lab, from the most recent *SARS* package.
- d. Checkout -- A test, typically focused on instrumentation and controls (I&C) and *safety instrumented systems* (SIS), to ensure that I&C components and SIS have been properly

installed, tagged, connected, and function as designed. Test variables may or may not be set near operating conditions and do not use reactive gases, chemicals, etc.

- e. Consequence -- An adverse result of a *linking event*, e.g., operator nausea due to natural gas exposure.
- f. Construction Permit -- The document which authorizes construction of a lab or *project* in accordance with its *SARS package*. A construction permit authorizes *project* construction, as well as the purchase of equipment, supplies, and materials.
- g. CRADA -- Cooperative Research and Development Agreement.
- h. DD -- Division Director.
- i. Decommission -- To remove from operations and dismantle.
- j. Design Envelope -- Design limitations in pressure, temperature, process conditions, or equipment specified for a given *project*. (Note: The design envelope must encompass the *operating envelope* to help ensure safety, e.g., if the temperature design envelope for a *project* is no less than 0 °F and no more than 100 °F, then the operating envelope shall not be less than 0 °F and not more the 100 °F.)
- k. EAOD -- Engineering Applications and Operations Division.
- l. Engineering Control -- A *mitigation* method carried out through *EAOD* authorized design practices, standards, and codes, e.g., designing process piping to the requirements of ASME B31.3. Engineering controls are the first line of defense against *hazardous consequences* and are preferred over all other *mitigation* methods.
- m. ES&H -- Environment, Safety, and Health.
- n. ES&HD -- Environmental, Safety, and Health Division.
- o. ES&H Representative -- The assigned *ES&H* primary point of contact to the *project*.
- p. ES&H SARS File -- The *SARS* file located in the *ES&H* record keeping system.
- q. HA -- Hazards analysis. A discovery tool used to raise awareness of potential *hazardous consequences* associated with a *project*.
- r. Hazard -- A condition that may lead to a *consequence*, e.g., the use of natural gas in a project.

- s. Hazardous Consequence -- A *consequence* with an unacceptable level of *risk* to NETL workers, the public, the environment, or property, e.g., a large uncontrolled natural gas explosion caused by a leak in a natural gas pipe.
- t. HC -- Hazard chart. A chart that describes a *hazardous consequence* associated with a *project*, *mitigation* method(s) to eliminate the *hazardous consequence*, or reduce the *risk* to an acceptable level and provides the status of the *mitigation* method(s).
- u. Impact -- The magnitude of a *consequence*.
- v. Line Management -- NETL line management (in this Procedure) is the *OST AD*, *DD*, or both, who have authority over the *project*.
- w. Linking Event -- An occurrence or situation, e.g., a gas leak, that links a *hazard*, e.g., natural gas in a pipe, to a *consequence*, e.g., operator nausea due to natural gas exposure. Also referred to as an event.
- x. Mitigation Method -- The implementation of *engineering* or *administrative controls*, *safety instrumented systems*, or *personal protective equipment* to eliminate a *hazardous consequence* or reduce the associated *risk(s)* to an acceptable level.
- y. Modifications Permit -- The document which authorizes significant changes to a lab or *project* in accordance with its *SARS package*.
- z. Operating Envelope -- Operating limitations in pressure, temperature, process conditions, or equipment specified for a given *project*. The operating envelope is limited by the *design envelope* (see *design envelope* definition).
- aa. Operations Permit -- The document which authorizes operations for a lab or *project* in accordance with its *SARS package*.
- bb. OST -- Office of Science and Technology.
- cc. OST DD -- *OST* Division Director. The *OST DD* who has authority over the *project*, overseeing the planning and execution of a *project* being reviewed under the *SARS* process. The *OST DD* is assigned by the *OST AD* and is typically the supervisor of the *RP*.
- dd. PPE -- Personal protective equipment. A *mitigation* method serving as the last line of defense against *hazardous consequences* (gas masks, nitrile gloves, Tyvek suits).
- ee. PQAE -- Project quality assurance engineer. The *PQAE* is the primary *EAOD* Representative to the *project*.
- ff. Probability -- The likelihood that a *consequence* will occur.

- gg. Project -- One body of *OST* work that is covered in one *SARS package*. This body of work shall be under the oversight of one person who is responsible for the contents of the *safety analysis*. This body of work may be a single research activity or multiple related research activities. Additionally, this body of work may focus on a laboratory, which supports other projects, and does not function to serve its own research goals. The definition of the word project may be further clarified by the *OST DD*.
- hh. Project SARS File -- The abbreviated form of the *ES&H SARS file* located at the *project* site. Refer to Section 9.d.4 for more information regarding the project SARS file.
- ii. Proximal -- Located within the same lab, test cell, or bay area.
- jj. Quality Check -- A review to ensure the review level of the *safety analysis* is correct and that all appropriate contents of the *safety analysis* are present and adequate for external-to-division reviews.
- kk. Risk -- The product of the *probability* and the *impact* associated with a *consequence*.
- ll. RP -- Responsible person. The RP is the DOE employee most responsible for the overall operation and results of the *project*, as well as the *SARS package* and *files*.
- mm. SA -- Safety analysis. The document generated for the purpose of obtaining a *SARS permit*, prior to being reviewed externally to the division from which it originates.
- nn. Safety -- In this Procedure, safety encompasses environment, safety, and health considerations.
- oo. SARS -- Safety Analysis and Review System.
- pp. SARS Package -- The document generated for the purpose of obtaining a *SARS permit*.
- qq. SARS Review Committee -- The Committee formed in accordance with this Procedure, to review a *safety analysis* and provide feedback for the *RP* seeking a *SARS permit*.
- rr. Shakedown -- Tests carried out by *project* personnel to fully confirm the design of the *project*. The shakedown variables are typically set near operating conditions and use process gases, chemicals, etc.
- ss. Significant Change -- A change in the *project* that requires a *modifications permit* before the change can be implemented. *Project* relocation, changing the approved *operating or design envelope*, and *decommissioning* are all examples of significant changes. Refer to Section 9.d.4 for further explanation.
- tt. SIS -- Safety instrumented system. A *mitigation* method carried out through automated instrumentation and controls, e.g., safety interlocks. Safety instrumented systems are the

third line of defense against *hazardous consequences* and are preferred over *personal protective equipment*.

- uu. Standards -- The DOE requirements, regulatory standards, consensus standards, and best management practices recognized (e.g., on the NETL's focused standards list) as requirements for NETL.
- vv. SSC -- Site support contractor.
- ww. Use Permit -- The written approval of the Office of Business and Logistics AD to occupy a facility at NETL, in accordance with the Facility Safety Analysis and Review System Procedure.

5. QUALITY CONTROL.

- a. Concerns or ideas for improving the SARS process should be directed to the SARS Procedure Subject Matter Experts (SMEs). SMEs are listed on the ES&H and the EAOD web pages.
- b. Significant changes to this Procedure shall be reviewed and discussed using a team approach that includes OST DDs.
- c. The quality and content of the safety analysis is the responsibility of the RP.

6. RESPONSIBILITIES.

- a. The RP shall:
 - (1) Take part in all required training pertaining to this Procedure, as well as read and understand it.
 - (2) Be responsible for the content of the safety analysis.
 - (3) Ensure that the development and contents of the safety analysis are compliant with the requirements of this Procedure, by being actively involved with its creation.
 - (4) Estimate the review level for the safety analysis.
 - (5) Review the hazards analysis report and hazard charts of any and all proximal projects when applying for a SARS permit.
 - (6) Provide a copy of his/her hazards analysis report and hazard charts to RPs of existing proximal projects, upon receiving his/her SARS permit.

- (7) Respond to all concerns raised by the PQAE, ES&H Representative, other Safety Analysis Review Committee members, the project area inspections, and the facility authorization, either by addressing the concern with a mitigation plan or by explaining the RP's disagreement with the concern.
- (8) Notify the PQAE and ES&H Representative when the project is ready to be reviewed and/or inspected.
- (9) Ensure that the mitigation methods described in the hazard charts have been implemented by the required activity (construction or operations).
- (10) Ensure that all staff associated with the project have reviewed and understood the project's hazards, linking events, and consequences, as well as the methods to be used for their elimination, reduction, mitigation, and control prior to commencing project construction, operation, or modification.
- (11) Post the most recent permit(s) and annual assessment sticker(s) in the project area(s).
- (12) Ensure that his/her project is in compliance with the requirements of this Procedure.
- (13) Keep the OST DD informed of changes to the project which may be "significant" as per the definition and examples given in this Procedure. If the RP is uncertain whether a change may be significant, he/she shall consult the assigned ES&H Representative or PQAE, accordingly.
- (14) Assist the ES&H Representative and PQAE during the annual assessment.
- (15) Maintain the SARS files by adding any and all forms of information that are relevant to the current safety, environmental, design, and quality aspects of the project. This information shall be given to the ES&H Representative for entry into the SARS file.
- (16) Maintain all current project specific training records for operators and the RP. Any training records required for Research and Development (R&D) SSC project personnel shall be provided by the R&D SSC for inclusion in the safety analysis.
- (17) Follow all requirements of the NETL Research and Development Project Design Standard.

b. The ES&H Representative shall:

- (1) Take part in all required training pertaining to this Procedure, as well as read and understand it.
- (2) Provide SARS expert advice and facilitation services to OST personnel.
- (3) Review level 1 safety analyses and, typically, serve on review levels 2 and 3 Safety Analysis Committees.
- (4) Coordinate project area inspections and facility authorizations.
- (5) Schedule, coordinate, and conduct annual assessments of SARS projects, assign corrective action priority findings, as well as send findings and assessment results to the RP, OST DD, PQAE, and any other appropriate personnel.
- (6) Provide annual assessment stickers to the OST DD, along with a report of findings and recommendations based on the assessment.

c. The PQAE shall:

- (1) Take part in all required training pertaining to this Procedure, as well as read and understand it.
- (2) Provide SARS expert advice and HA team member services to OST personnel by generating a list of required standards and codes for the project, assisting with safety integrity level determinations and offering mitigation recommendations, as requested by the RP.
- (3) Serve on the Hazards Analysis Committee for his/her assigned projects or appoint a proxy.
- (4) Facilitate hazards analysis studies other projects.
- (5) Coordinate engineering input and design reviews.
- (6) Coordinate quality control and assurance services.
- (7) Review level 1 safety analyses and typically serve on levels 2 and 3 Safety Analysis Committees.
- (8) Author the SOW for an independent hazards analysis contract (review level 3 projects only).

- (9) Serve as the Contracting Officer's Representative for an independent hazards analysis contract (review level 3 projects only).
 - (10) Review the ES&H and project SARS files prior to the time of the project annual ES&H assessment to determine if they are being maintained.
 - (11) Serve as a team member for annual ES&H assessments.
- d. The OST DD shall:
- (1) Take part in all required training pertaining to this Procedure, as well as read and understand it.
 - (2) Ensure that projects under his/her jurisdiction have undergone a safety analysis and review and have received the proper SARS permit prior to being constructed, operated, or significantly modified.
 - (3) Appoint the RP.
 - (4) Ensure that the RP maintains project specific training records as specified in this Procedure. This endorsement shall be inferred as part of the SARS package approval.
 - (5) Approve the review level for the safety analysis, at his/her discretion.
 - (6) Conduct the quality check of the safety analysis prior to dissemination for external-to-division reviews. This responsibility may be delegated.
 - (7) Provide specific reasons to the RP if a SA fails to meet the quality check.
 - (8) Designate Safety Analysis Review Committee members from within his/her division.
 - (9) Approve SARS packages, at his/her discretion.
 - (10) Submit approved SARS packages to the OST AD and request that the appropriate permit be issued. Exception: Review level 1 modifications permits, which are approved by the OST DD directly, at his/her discretion.
 - (11) Determine when proposed project modifications constitute a significant change, in accordance with this Procedure. If the OST DD is uncertain whether a change is significant, he/she shall consult the assigned ES&H Representative or PQAE, accordingly.
 - (12) Ensure that an adequate number of his/her employees have been recommended for EAOD sponsored hazards analysis techniques training. An "adequate number" of

employees shall be based upon the need for peer participated hazards analyses in the specific OST Division, but shall be no less than three.

- (13) Deliver authorized permits to the appropriate RP for posting at the project site(s).
 - (14) Award annual assessment stickers to projects within his/ her division, at his/her discretion. The OST DD shall consider information in the annual assessment report from the ES&H Representative when deciding whether to award the annual assessment sticker(s).
 - (15) Ensure that all appropriate employees under his/her jurisdiction have been trained in the use of this Procedure.
- e. The ES&H DD shall:
- (1) Take part in all required training pertaining to this Procedure, as well as read and understand it.
 - (2) Assign an ES&H Representative to each project.
 - (3) Designate the ES&HD Committee members tasked with review of the safety analysis, including Committee chairpersons, when needed.
 - (4) Ensure that the designated ES&HD employees have been trained in the use of this Procedure.
- f. The EAOD DD shall:
- (1) Take part in all required training pertaining to this Procedure, as well as read and understand it.
 - (2) Assign a PQAE to each project.
 - (3) Designate the EAOD Committee members tasked with review of the safety analysis, including Committee chairpersons, when needed.
 - (4) Ensure that an adequate number of his/her employees are trained to perform all required hazard analysis techniques, both as team members and facilitators.
 - (5) Provide HA techniques training to OST personnel.
 - (6) Ensure that the designated EAOD employees have been trained in the use of this Procedure.

g. The OST AD shall:

- (1) Take part in all required training pertaining to this Procedure, as well as read and understand it.
- (2) Approve construction permits, operations permits, and review levels 2 and 3 modifications permits, at his/her discretion. This responsibility may be delegated to line management.
- (3) Issue the approved permit(s) by giving signed original to the OST DD and a copy to the ES&HD.

7. TRAINING REQUIREMENTS.

- a. A designated number of OST employees, from each division, shall be trained to perform hazard analysis techniques.
- b. All OST and ES&H employees involved in the SARS process shall be trained in the use of this Procedure.
- c. Project personnel shall be appropriately trained on the unique hazards present in the project.
- d. Project personnel shall be trained as per the requirements in the SARS package.

8. DOCUMENT CONTROL.

- a. The ES&HD shall generate an unsigned SARS permit. In the event that multiple permits are needed for a single SARS package, the RP shall request the ES&HD produce the appropriate number of unsigned permits. The ES&HD shall assign a unique identification letter and number to the construction, operation, and modification permit. When practical, the operations permit number shall be the same as the construction permit number. Also, when practical, the modification permit number shall be the same as the construction permit number, followed by the modification revision (by letter).
- b. Only permits bearing an original authorized signature, in accordance with this Procedure, shall be considered valid. Copies of permits will not be accepted.
- c. The RP shall post the permit(s) at the project site(s).
- d. All approved SARS packages, copies of their corresponding permits, and other appropriate documents shall be kept by the ES&HD in the ES&H SARS file. Each file shall be given a unique file number by ES&HD, which will typically match the number on the construction permit.

- e. The ES&H SARS file shall be kept for the life of the project. Upon termination of a project, the SARS file shall be given to the OST AD to archive as he or she sees fit.
- f. Project specific training records shall be maintained by the RP via NETL Form 450.1-5, and stored in the ES&H SARS file.
- g. This Procedure shall take effect on April 15, 2003. SARS Permits approved after April 15, 2003, shall accompany SARS packages which comply with this Procedure.

9. PROCEDURE.

- a. Introduction -- Every NETL on-site R&D project shall undergo a safety analysis and review and obtain an appropriate SARS permit prior to being constructed, operated, significantly modified, or decommissioned. If a review of the SARS package shows that the risks associated with the project are acceptable to OST line management, a SARS permit shall be issued. After permit issuance, the activity described in the SARS package may commence.
- b. Permitting Process -- To aid readers of this document, a flow diagram of the permitting process is included as Attachment 6. Key points in the process are cross-referenced, in parentheses, to their corresponding steps in the diagram. It is essential that readers study this flow diagram, in addition to the text sections of this Procedure, to obtain a full understanding of the SARS process.

There is no guarantee that once a safety analysis is submitted for review, it or a permit will be approved.

- (1) A project or project modification is conceived (Step 1).
- (2) The RP obtains permission from his/her DD to begin work on a safety analysis for the project or modification.
- (3) The RP then contacts the ES&H and EAO DDs who respectively assign an ES&H Representative and a PQAE to the project (Step 3).
- (4) The RP arranges a meeting with the ES&H Representative and the PQAE (whether together or separately) to determine the project specific safety analysis requirements using Form 421.1-7. The OST DD then reviews the project specific safety analysis requirements with the RP to determine the need for additional requirements (Step 4). Typically, a project description and a PFD will be needed for this step.
- (5) At this point the RP estimates the review level of the safety analysis using Attachment 5 (Step 5). If needed, the RP should consult his/her ES&H Representative or PQAE for assistance with this step.

- (a) A hazards analysis (HA) is then conducted for the project. If the review level is either 1 or 2, the HA shall be conducted by an OST HA team (Step 5a).
 - (b) If the review level is 3, the HA shall be conducted by an independent team (Step 5b). Specific details regarding hazards analyses are contained in Attachment 4. It is recommended that the detailed design of the project begin after the HA, to prevent redesign of project components.
- (6) The RP now begins assembling the safety analysis (SA) (Step 6), using the appropriate attachment (Attachment 1 for a “construction” permit, Attachment 2 for an “operations” permit, or Attachment 3 for a “modifications” permit) to this Procedure and his/her project specific safety analysis requirements form, F 421.1-7. If needed, the RP should consult the PQAE, ES&H Representative, OST DD, and any other personnel necessary to obtain guidance and clarification for the SA.
- (7) Once the RP feels he/she has completed his/her portions of the SA, the RP shall sign the appropriate location of the SA cover sheet. The PQAE and ES&H Representative shall review the SA (Step 7). The intent of this review is to gather input from resources other than the RP. The ES&H Representative’s and PQAE’s reviews shall be added to the SA, along with the RP’s responses. The RP must address all issues and concerns of all the SA reviewers. The ES&H Representative and PQAE shall sign the appropriate locations on the SA cover sheet once they feel their issues and concerns have been addressed. Once the SA has been returned to the RP, after each review, he or she shall sign the cover sheet in the appropriate location. Although this step is represented in Attachment 6 as a serial process, it is more accurate to describe it as an interactive process where the RP, PQAE, and ES&H Representative discuss and clarify expectations and requirements during the creation of the safety analysis. The ES&H Representative and PQAE signatures come at the end of this interactive period.
- (8) The RP forwards the SA to the OST DD for his or her quality check (Step 8). If the SA does not meet the requirements, the DD returns it to the RP for revision and it re-enters the permitting process at Step 6 of the flow diagram. If the SA passes the quality check, then the OST DD shall sign the appropriate location of the SA cover sheet and the SA proceeds to Step 9 of the flow diagram.
- (9) Step 9 of the flow diagram is a decision block.
 - (a) If the SA review level is 2 or 3, then it is reviewed by a SARS Review Committee. The OST, ES&H, and EAO DDs shall nominate members to make up the SARS Review Committee for that safety analysis. A Committee chairman, from either the ES&H or EAO Division, shall also be selected by the DDs. If any of the DDs does not agree with the nomination of a Committee member (from any of the divisions), a new member must

be appointed. The ES&H Representative and PQAE shall serve on the Committee or designate a proxy. Once the Committee has been formed, it shall review the SA (Step 9a).

- (b) The intent of this review is to gather input from resources other than the RP, ES&H Representative, and PQAE. The Committee members' reviews shall be added to the SA, along with the RP's responses (Step 9b).
 - (c) RPs must address all issues and concerns of all the SA reviewers (Step 9c). The ES&H Representative and PQAE need not submit a second review of the SA, if they feel a second review will not add value. Once the Committee's reviews and the RP's responses are added to the SA, the document is termed a SARS package and is sent to the OST DD for review. Once the Committee members feel their issues and concerns have been addressed, the Committee chairman shall sign the appropriate location on the cover sheet.
- (10) If the SA review level is 1, then its review as a SA is considered complete. At this point, the SA becomes a SARS package and OST DD reviews the package (Step 10).
 - (11) The intent of the OST DD's review (Step 11) is to decide whether to approve the SARS package. This decision shall be based on project merit, reasonableness, comprehensiveness, risk acceptability, and the review level.
 - (a) If the OST DD rejects the SARS package, he/she returns it to the RP with a description of issues and concerns (Step 11a). The RP may revise the SARS package, in response to the issues and concerns stated, and resubmit it to the DD for review (Step 5).
 - (12) If the OST DD approves the SARS package (Step 12), then he/she will sign the appropriate location on the cover sheet and it proceeds to Step 13 of the flow diagram.
 - (13) Step 13 of the flow diagram is a decision block.
 - (a) If the SARS package is for a review level 1 modifications permit, then the OST DD obtains a blank SARS permit from the ES&HD and signs his or her approval (Step 13a). The SARS package, along with a photocopy of the authorized permit, is sent to the ES&HD for record keeping (Step 18).
 - (14) If the SARS package is not for a review level 1 modifications permit, then it is sent to the ES&HD, where a blank permit is generated and included with the SARS package (Step 14). The package and blank permit are sent to the OST AD for review.

- (15) The OST AD reviews the SARS package.
- (16) Step 16 of the flow diagram is decision block.
 - (a) If the OST AD rejects the SARS package, he/she returns it to the RP with a description of issues and concerns (Step 16a). The RP may revise the SARS package, in response to the issues and concerns stated, and resubmit it to the DD for review (Step 15).
- (17) If the AD approves the permit, he or she shall authorize it with his/her signature and send the approved permit and SARS package to the ES&HD (Step 17).
- (18) The approved permit is then sent to the RP (Step 18).
- c. SARS Permit Conditions -- The following conditions shall be met in order for a project to maintain its permit in good standing. If a project fails to keep its permit in good standing, the OST DD or AD may suspend or cancel the permit, at his/her discretion.
 - (1) The most recently approved permit(s) must be posted in the project area(s).
 - (2) Once a permit is issued, it expires only upon the approval of a new permit. The exception to this is if the permit is cancelled.
 - (3) The OST DD or AD may suspend or cancel a SARS permit. A written record of this action, including the reason(s) for the action, shall be submitted to the RP for addition to the ES&H SARS file. The party initiating this action shall also notify the ES&H Representative, ES&H DD, PQAE, EAO DD, and project personnel.
 - (4) A project SARS file shall be maintained at the project site. As a minimum, this file shall contain controlled documents or copies from the ES&H SARS file of:
 - (a) The latest approved SARS package.
 - (b) Standard Operating Procedures.
 - (c) P&IDs.
 - (d) PFDs.
 - (e) A list of authorized operators, RP, OST DD, ES&H Representative, and PQAE.
 - (5) An ES&H assessment team shall conduct an annual assessment on all SARS permitted projects. This assessment shall include:

- (a) A determination of the continued applicability of the SARS file (i.e., no significant modifications have been made since the permit issuance). An RP signature/notification attesting to the continued applicability of the SARS file shall be required annually (see Form 421.1-2).
- (b) ES&HD inspections (project area chemical hygiene, OSHA, and environmental).
- (c) A review of outstanding inspection findings for the project area.
- (d) Reviews of the SARS files and the project area for engineering design and QA/QC concerns.

Records from each annual assessment shall be added to the ES&H SARS file.

Annual assessment teams shall include the ES&H Representative, the PQAE, the Environmental Manager, and RP (or designee), as a minimum.

Annual assessment stickers bearing the date of the most recently completed annual assessment shall be placed on the SARS permit by the RP. Annual assessment stickers shall be issued by the ES&H Representative and awarded by the OST DD. Stickers shall be awarded at the discretion of the OST DD.

Findings from the annual assessment shall be:

- (a) Assigned a priority of 1, 2, 3, or 4 by the assessor or ES&H Representative.
 - Priority 1 findings are urgent actions and shall be corrected within 7 days.
 - Priority 2 findings are serious deficiencies and shall be corrected within 45 days.
 - Priority 3 findings are non-serious deficiencies and shall be corrected within 120 days.
 - Priority 4 findings are de-minimus deficiencies and shall be corrected within 365 days.
- (b) Sent to the RP for resolution and to the OST DD as notification.
- (6) When new project personnel are assigned, the SARS files shall be updated. Information required for existing project personnel shall be updated to include the new personnel.

- (a) If a new RP is assigned to the project, the new RP shall sign a statement (for inclusion in the ES&H SARS file), asserting his/her knowledge of the contents of the ES&H SARS file and acceptance of the limits and other terms described in it. If the new RP does not accept the conditions put forth in the ES&H SARS file, he/she shall submit a modifications safety analysis, with the limits and terms he/she finds acceptable.

The new RP shall review the SARS files and take appropriate action by the time of the project's first annual assessment, after his/her appointment.

- (b) New project operators or personnel must review and understand the project's hazards, linking events, hazardous consequences, as well as the methods being used for hazard/risk elimination, reduction, mitigation, and control. New project personnel shall also be trained according to the requirements in the ES&H SARS file.

Operational training forms for new project operators or personnel shall be incorporated into the SARS files, via Form 450.1-5, "Operational Training Form." This shall be done before the new personnel may operate the project.

- (c) If a project receives a new OST DD, the new OST DD shall sign a statement (for inclusion in the ES&H SARS file), asserting his/her knowledge of the contents of the ES&H SARS file, and acceptance of the limits and other terms described in it. If the new DD does not accept the conditions put forth in the ES&H SARS file, he/she shall require the RP to obtain a modifications permit with limits and terms he/she finds acceptable.

The new OST DD shall review the ES&H SARS files for all projects under his/her jurisdiction and take appropriate action at the time of each project's first annual assessment, after his/her appointment.

- d. Permit Types -- The following subsections discuss the aspects of the different types of permits, namely, Construction, Operations, Combined Construction and Operations and Modifications (to Construction, Operations, or both).

- (1) Construction Permit -- A construction permit is obtained by completing a safety analysis per the requirements of Attachment 1. Attachment 1 describes the content requirements for a construction safety analysis. To be considered valid, all construction permits must be approved by the OST AD.

Exceptions:

The OST DD may approve project purchases prior to issuance of the construction permit. However, no construction shall occur until a construction permit is posted in the project area.

- (2) Operations Permit -- An operations permit is obtained by completing a safety analysis per the requirements of Attachment 2. Attachment 2 describes the content requirements for an operations safety analysis. To be considered valid, all operations permits must be approved by the OST AD. No project shall be operated unless the operations permit is posted in the project area.

Exceptions:

For projects seeking an operating permit in a facility without a valid use permit, the OST AD may consider the facility hazards when determining whether to approve the permit.

- (3) Combined Construction and Operations Permit -- With OST DD authorization, the construction and operation (C&O) safety analyses may be combined for review level 1 projects only, to obtain a combined C&O permit. To be considered valid, all C&O permits must be approved by the OST AD. No project construction, shakedown, or operations may take place until a C&O permit is posted in the project area.
- (4) Modifications Permit -- A modifications permit is obtained by completing a safety analysis per the requirements of Attachment 3. Attachment 3 describes the content requirements for a modifications safety analysis. To be considered valid, all modifications permits must be approved by the OST AD. A project shall not be significantly changed until the modifications permit is posted in the project area.

Whether or not a change to a project is significant shall be determined by the OST DD, or if it leads to any one of the following:

- (a) Addition of a hazard.
- (b) A change in the type of hazard.
- (c) An increase in probability or impact of a consequence.
- (d) A change in mitigation method.
- (e) Addition of a hazardous consequence from a proximal project.

Project relocation, increasing the approved operating or design envelopes, and project decommissioning are all examples of significant changes and always require a modifications permit.

Project personnel changes do not necessarily require a modifications permit. However, a record of the project personnel changes and his/her training status is required in the SARS files.

Exceptions:

- (a) The OST DD shall approve review level 1 modifications permits, at his/her discretion.
 - (b) The modifications permit shall be posted prior to implementing the significant change(s), unless this requirement is waived by the OST DD. If this requirement is waived, the RP must obtain a record of authorization from the OST DD and place it in the SARS files.
- e. CRADA and Off-site Projects -- For projects operating on DOE-owned or leased property, personnel shall follow this Procedure. For projects operating on other property, personnel shall follow the safety analysis process of the authority having jurisdiction. For off-site projects where either the authority having jurisdiction or the ES&H authority is not clearly known, personnel shall follow this Procedure. A DOE employee, who is working on the partner's property and is concerned about safety:
- (1) Is not required to perform activities that he/she believes cause unacceptable personal risk.
 - (2) Shall report the situation to his/her NETL supervisor for resolution.

10. ATTACHMENTS.

- a. Attachment 1 -- Construction Safety Analysis Content Requirements.
- b. Attachment 2 -- Operations Safety Analysis Content Requirements.
- c. Attachment 3 -- Modifications Safety Analysis Content Requirements.
- d. Attachment 4 -- Hazards Analysis and Hazard Chart Guidance.
- e. Attachment 5 -- Review Level Ramifications and Determination Guidance.
- f. Attachment 6 -- Permitting Process Flow Diagram.

- g. Attachment 7 -- Shakedown Activities Content Requirements.

Associate Director, OST

Associate Director, OBL

ATTACHMENT 1

CONSTRUCTION SAFETY ANALYSIS CONTENTS REQUIREMENTS

Below are the minimum requirements for a project's construction safety analysis. The OST DD may require additional information. Safety analyses shall be numbered according to the respective sections of this attachment.

1. Cover Sheet. Form 421.1-8 is a blank cover sheet. Fill in all of the blanks at the appropriate time. The RP should seek guidance from his/her PQAE in completing this form.
2. Specific Safety Analysis Requirements / Table of Contents. A checklist of safety analysis requirements is included in Form 421.1-7. The RP shall meet with his/her PQAE, ES&H Representative and OST DD to complete the form and, in turn, determine the specific requirements of his/her safety analysis. Once this form has been completed, it shall serve as a table of contents for the safety analysis.
3. Project Description. This shall include a summary of the project operations, the design and preliminary operation envelopes, the basic chemical and physical reactions, and the intended location. Descriptive text should not duplicate detailed information that is shown elsewhere in the safety analysis, the process flow diagram (PFD), or the process and instrumentation diagram (P&ID). In most cases, this section should not be more than three pages long.
4. Engineering Design Requirements. The RP should consult his/her PQAE with questions regarding this section.

Certain requirements of this section may be excluded from the construction safety analysis, at the recommendation of the PQAE, with concurrence from the OST DD.

This section shall include:

- a. Stream summary table(s).
- b. PFD(s).
- c. P&ID(s).
- d. A plot plan of the project area, depicting, as a minimum, the egress route and major project equipment.
- e. Design envelope. This section describes the design limits (pressure, temperature, or any other energy form) for the project. The design limits should provide maximum and minimum values, whenever possible.

- f. A preliminary operations envelope. This section describes the typical operating conditions (pressure, temperature, or any other energy form) for the project.
- g. Standards and codes. This section shall include a list of the standards and codes used in the design of the project.

5. ES&H Requirements. The RP should consult his/her ES&H Representative with questions regarding this section.

Certain requirements of this section may be excluded from the construction safety analysis, at the recommendation of the ES&H Representative, with concurrence from the OST DD.

This section shall include:

- a. External ES&H permits, including, but not limited to, air, NPDES, utility board, and hazardous waste permits. This section shall also include the status of required external ES&H permits, e.g., expected date of required permits - if not yet acquired, expiration date of obtained permits, etc.
- b. NEPA sign-off, refer to Form 451.1-1/1.
- c. Waste minimization information. Complete and attach Form 435.1-1 to document that a pollution prevention and waste/resource minimization opportunity assessment has been conducted for the project.
- d. ISO 14001 Significant Environmental Impact Scoring Matrix, refer to Form 450.1-2.

6. Facility Authorization. Refer to Form 421.1-4.

7. Hazard Analysis Report and Charts. The RP should consult his/her PQAE with questions regarding this section.

Specific information regarding Hazards Analysis (HA), Hazards Analysis Report (HAR), Hazard Charts (HCs), and the requirements for each type of safety analysis (construction, operation, and modification) is contained in Attachment 4. Additional information regarding HA is contained in the DOE Handbook, "Chemical Process Hazards Analysis," DOE-HNDBK-1100-96.

This section of the safety analysis shall contain the HAR and resulting HCs.

8. Shakedown Activities. Refer to Attachment 7 for shakedown activities content requirements.

This section should be omitted if the project will not be going through shakedown activities prior to obtaining an operations permit.

9. Reviews and Responses. This section shall include review statements from all of the safety analysis reviewers. The RP's responses to reviewer's issues shall be included in this section as well.
10. Unique Construction Hazards. If project construction will cause unique hazardous consequences, this information shall be conveyed to the DOE party responsible for construction safety. Describe the hazards and how the communication was accomplished.

ATTACHMENT 2

OPERATIONS SAFETY ANALYSIS CONTENTS REQUIREMENTS

Below are the minimum requirements for a project's operations safety analysis. The OST DD may require additional information. Safety analyses shall be numbered according to the respective sections of this attachment.

1. Cover Sheet. Form 421.1-8 is a blank cover sheet. Fill in all of the blanks at the appropriate time. The RP should seek guidance from his/her PQAE in completing this form.
2. Specific Safety Analysis Requirements/Table of Contents. A checklist of safety analysis requirements is included in Form 421.1-7. The RP shall meet with his/her PQAE, ES&H Representative, and OST DD to complete the form and, in turn, determine the specific requirements of his/her safety analysis. Once this form has been completed, it shall serve as a table of contents for the safety analysis.
3. Project Description. This shall include a summary of the project operations, the design and operation envelopes, the basic chemical and physical reactions, and the location. Descriptive text should not duplicate detailed information that is shown elsewhere in the safety analysis, the process flow diagram (PFD), or the process and instrumentation diagram (P&ID). In most cases, this section should not be more than three pages long.
4. Engineering Design Requirements. The RP should consult his/her PQAE with questions regarding this section.

Certain requirements of this section may be excluded from the operations safety analysis, at the recommendation of the PQAE, with concurrence from the OST DD.

This section shall include:

- a. Stream summary table(s).
- b. PFD(s).
- c. P&ID(s).
- d. A plot plan of the project area, depicting, as a minimum, the egress route and major project equipment.
- e. Design envelope. This section describes the design limits (pressure, temperature, or any other energy form) for the project. The design limits should provide maximum and minimum values, whenever possible.

- f. Operations envelope. This section describes the typical operating conditions (pressure, temperature, or any other energy form) for the project.
- g. Controlled project procedures. These shall be completed and available for review, upon request. Photocopies of the document control cover sheets, Form 421.1-3, for the project procedures shall be included in this section of the safety analysis.
- h. Standards and codes. This section shall include a list of the standards and codes used in the design of the project.
- i. Operations requirements. Describe how the project will be operated in terms of labor-hour needs. (For example: Will the project run unattended? Will people work on it alone? Will it operate 24 hours per day? For how many days in a row?)

5. ES&H Requirements. The RP should consult his/her ES&H Representative with questions regarding this section.

Certain requirements of this section may be excluded from the operations safety analysis, at the recommendation of the ES&H Representative, with concurrence from the OST DD.

This section shall include:

- a. External ES&H permits, including, but not limited to, air, NPDES, utility board, and hazardous waste permits. This section shall also include the status of required external ES&H permits (expected date of required permits - if not yet acquired, expiration date of obtained permits, etc.).
- b. NEPA sign-off, refer to Form 451.1-1/1.
- c. Waste minimization information. Complete and attach Form 435.1-1 to document that a pollution prevention and waste/resource minimization opportunity assessment has been conducted for the project.
- d. ISO 14001 Significant Environmental Impact Scoring Matrix, refer to Form 450.1-2.
- e. Industrial hygiene monitoring requirements, Form 421.1-6. Describe the industrial hygiene monitoring that will be performed during initial project operation to ensure operator health and validate safe operations.
- f. Operational and environmental management system training information. Complete and attach Form 450.1-5 to document the operational and environmental management system training that is required and has been received for the project. In addition, describe and/or list the training required to protect project operators from project-specific hazards. Training will be required before operators may operate the project. Certification of the operators having had this training (e.g., operational training, environmental management

system training, and hazard-specific training) shall be in the SARS file prior to any operator being allowed to operate the project.

- g. ISO 14001 Screening Analysis Questionnaire, Form 450.1-4.
 - h. PPE Hazard Assessment, Form 440.1-12/1.
 - i. Inspection Results, Form 421.1-1/1.
6. Facility Authorization. Refer to Form 421.1-4 (for combined construction and operation permit).
 7. Hazard Analysis Report and Charts. The RP should consult his/her PQAE with questions regarding this section.

Specific information regarding Hazards Analysis (HA), Hazards Analysis Report (HAR), Hazard Charts (HCs), and the requirements for each type of safety analysis (construction, operation, and modification) is contained in Attachment 4. Additional information regarding HA is contained in the DOE Handbook, "Chemical Process Hazards Analysis," DOE-HNDBK-1100-96.

This section of the safety analysis shall contain the HAR and resulting HCs.

8. Shakedown Activities. Refer to Attachment 7 for shakedown activities content requirements.
9. Reviews and Responses. This section shall include review statements from all of the safety analysis reviewers. The RP's responses to reviewer's issues shall be included in this section as well.

ATTACHMENT 3

MODIFICATIONS SAFETY ANALYSIS CONTENTS REQUIREMENTS

Below are the minimum requirements for a project's modification safety analysis. The OST DD may require additional information. Safety analyses shall be numbered according to the respective sections of this attachment.

1. Cover Sheet. Form 421.1-8 is a blank cover sheet. Fill in all of the blanks at the appropriate time. The RP should seek guidance from his/her PQAE in completing this form.
2. Specific Safety Analysis Requirements/Table of Contents. A checklist of safety analysis requirements is included in Form 421.1-7. The RP shall meet with his/her PQAE, ES&H Representative, and OST DD to complete the form and, in turn, determine the specific requirements of his/her safety analysis. Once this form has been completed, it shall serve as a table of contents for the safety analysis.
3. Modification(s) Description. This shall include a summary of the proposed modification(s) to the following: the design and/or operations envelope, the basic chemical and physical reactions, and project location. Descriptive text should not duplicate detailed information that is shown elsewhere in the safety analysis, the process flow diagram (PFD), or the process and instrumentation diagram (P&ID). In most cases, this section should not be more than three pages long.
4. Modification(s) to Construction. For projects modifying physical aspects, e.g., structural members, pressure vessels, piping, project location, etc., include the following in the safety analysis.
 - a. Engineering Design Requirements. The RP should consult his/her PQAE with questions regarding this section.

Certain requirements of this section may be excluded from the modifications safety analysis, at the recommendation of the PQAE, with concurrence from the OST DD. With approval from the PQAE, changes may be depicted by redlining, highlighting, or in some other easily recognizable way, existing documents and drawings.

This section shall include changes to the following:

- i. Stream summary table(s).
- ii. PFD(s).
- iii. P&ID(s).
- iv. A plot plan of the project area, depicting, as a minimum, the egress route and major project equipment.

- v. Design envelope. This section describes the design limits (pressure, temperature, or any other energy form) for the project. The design limits should provide maximum and minimum values, whenever possible.
 - vi. Operations envelope. This section describes the typical operating conditions (pressure, temperature, or any other energy form) for the project.
 - vii. Standards and codes. This section shall include a list of the standards and codes used in the design of the project.
- b. ES&H Requirements. The RP should consult his/her ES&H Representative with questions regarding this section.

Certain requirements of this section may be excluded from the modifications safety analysis, at the recommendation of the ES&H Representative, with concurrence from the OST DD. With approval from the ES&H Representative, changes may be depicted by redlining, highlighting, or in some other easily recognizable way, existing documents and drawings.

This section shall include changes to the following:

- i. Any external ES&H permits, including, but not limited to, air, NPDES, utility board, and hazardous waste permits. This section shall also include the status of required external ES&H permits (expected date of required permits - if not yet acquired, expiration date of obtained permits, etc.).
 - ii. NEPA sign-off, refer to Form 451.1-1/1.
 - iii. Waste minimization information. Complete and attach Form 435.1-1 to document that a pollution prevention and waste/resource minimization opportunity assessment has been conducted for the project.
 - iv. ISO 14001 Significant Environmental Impact Scoring Matrix, refer to Form 450.1-2.
 - v. Inspection Results, refer to Form 421.1-1/1. Since significant changes to a project are associated with a modifications permit, it is most often the case that the project will have to be reinspected and the updated Inspection Results Form included in the SA.
- c. Unique Construction Hazards. If the modification(s) will cause unique hazards, this information shall be conveyed to the DOE party responsible for construction safety. Describe the hazards and how the communication was accomplished.

5. Modification(s) to Operations. For projects modifying operational aspects, e.g., changing the operations envelope, changing the components of the chemical reactions, etc., include the following in the safety analysis.
- a. Engineering Design Requirements. The RP should consult his/her PQAE with questions regarding this section.

Certain requirements of this section may be excluded from the modifications safety analysis, at the recommendation of the PQAE, with concurrence from the OST DD. Information in the “Modifications to Operations” which is identical to that presented in the “Modifications to Construction” section may refer the reader to that specific section of the SA. With approval from the PQAE, changes may be depicted by redlining, highlighting, or in some other easily recognizable way, existing documents and drawings.

This section shall include changes to the following:

- i. Stream summary table(s).
- ii. PFD(s).
- iii. P&ID(s).
- iv. A plot plan of the project area, depicting, as a minimum, the egress route and major project equipment.
- v. Design envelope. This section describes the design limits (e.g., for pressure, temperature, or any other energy form) for the project. The design limits should provide maximum and minimum values, whenever possible.
- vi. Operations envelope. This section describes the typical operating conditions (e.g., for pressure, temperature, or any other energy form) for the project.
- vii. Controlled project procedures. These shall be completed and available for review, upon request. Photocopies of the document control cover sheets, Form 421.1-3, for the project procedures shall be included in this section of the safety analysis.
- viii. Standards and codes. This section shall include a list of the standards and codes used in the design of the project.
- ix. Operations requirements. Describe how the project will be operated in terms of labor-hour needs. (For example: Will the project run unattended? Will people work on it alone? Will it operate 24 hours per day? For how many days in a row?)

- b. ES&H Requirements. The RP should consult his/her ES&H Representative with questions regarding this section.

Certain requirements of this section may be excluded from the modifications safety analysis, at the recommendation of the ES&H Representative, with concurrence from the OST DD. Information in the “Modifications to Operations” which is identical to that presented in the “Modifications to Construction” section may refer the reader to that specific section of the SA. With approval from the ES&H Representative, changes may be depicted by redlining, highlighting, or in some other easily recognizable way, existing documents and drawings.

This section shall include changes to the following:

- i. Any external ES&H permits, including, but not limited to, air, NPDES, utility board, and hazardous waste permits. This section shall also include the status of required external ES&H permits (i.e., expected date of required permits - if not yet acquired, expiration date of obtained permits, etc.).
- ii. NEPA sign-off, refer to Form 451.1-1/1.
- iii. Waste minimization information. Complete and attach Form 435.1-1 to document that a pollution prevention and waste/resource minimization opportunity assessment has been conducted for the project.
- iv. ISO 14001 Significant Environmental Impact Scoring Matrix, refer to Form 450.1-2.
- v. Industrial hygiene monitoring requirements, Form 421.1-6. Describe the industrial hygiene monitoring that will be performed during initial project operation to ensure operator health and validate safe operations.
- vi. Operational and environmental management system training information. Complete and attach Form 450.1-5 to document the operational and environmental management system training that is required and has been received for the project. In addition, describe and/or list the training required to protect project operators from project-specific hazards. Training will be required before operators may operate the project. Certification of the operators having had this training (e.g., operational training, environmental management system training, and hazard-specific training) shall be in the SARS file prior to any operator being allowed to operate the project.
- vii. ISO 14001 Screening Analysis Questionnaire, NETL F 450.1-4.
- viii. PPE Hazard Assessment, NETL F 440.1-12/1.

- ix. Inspection Results, NETL F 421.1-1/1. Since significant changes to a project are associated with a modifications permit, it is most often the case that the project will have to be reinspected and the updated Inspection Results Form included in the SA.

6. Modification(s) to Construction or Operations. Include any of the following documents which will change, as a result of the proposed modification(s).

- a. Facility Authorization. Refer to Form 421.1-4.
- b. Hazard Analysis Report and Charts. The RP should consult his/her PQAE with questions regarding this section.

Specific information regarding Hazards Analysis (HA), Hazards Analysis Report (HAR), Hazard Charts (HCs), and the requirements for each type of safety analysis (construction, operation, and modification) is contained in Attachment 4. Additional information regarding HA is contained in the DOE Handbook, "Chemical Process Hazards Analysis," DOE-HNDBK-1100-96.

This section of the safety analysis shall contain the HAR and resulting HCs.

- c. Shakedown Activities. Refer to Attachment 7 for shakedown activities content requirements.
- d. Reviews and Responses. This section shall include review statements from all of the safety analysis reviewers. The RP's responses to reviewer's issues shall be included in this section as well.

ATTACHMENT 4

HAZARDS ANALYSIS AND HAZARD CHARTS GUIDANCE

The “Hazard Analysis Report and Charts” section of the safety analysis requires a Hazards Analysis Report (HAR) and Hazard Charts (HCs) for the project. Hazards Analysis (HA), HAR, and HCs are each described below.

1. Hazards Analysis

- a. Introduction: A HA shall be conducted for each project seeking a NETL SARS permit. The purpose of the HA is to identify, understand, and analyze hazardous consequences so that mitigation methods can be implemented to either eliminate the hazardous consequence or reduce the risk(s) to an acceptable level. The HA should identify as many significant project associated hazardous consequences as reasonably possible. The HA shall take into consideration the following hazards, as a minimum: operations, proximal, and shakedown activities (where applicable). The HA for successive SAs will revisit previous hazards analyses and revise them as needed.
 - i. Operations Hazards. Examples of operations hazards include, but are not limited to, toxic gases, temperature, pressure, electricity, etc. Operations hazards shall be considered for all SAs, regardless of the type of permit being sought. For construction-related safety analyses, it is understood that operations plans may be tentative in nature, however, the HAs shall be conducted as if the operations plans are final. When the HA for the operations (and modifications to operations) SA is conducted, the previous HA shall be revisited and revised as needed. Although it may not seem reasonable to conduct a hazards analysis involving project operations for a construction SA, it is done to help ensure that NETL builds only those projects which can be operated with an acceptable level of risk.
 - ii. Proximal Hazards. Examples of proximal hazards include, but are not limited to, proximal projects, proximal pressurized gas lines, power lines, etc. Proximal hazards shall be considered in HA for all types of safety analyses.
 - iii. Shakedown Hazards. Examples of shakedown hazards are typically the same as operations hazards, except they are reviewed under shakedown conditions. If shakedown activities are to be covered in the project’s SA and permit, then the hazards associated with shakedown shall be included in the HA.
- b. Hazards Analysis Process: This analysis shall be conducted or coordinated through EAOD. Once the RP has created a project description and PFD and has determined the review level of his/her safety analysis, he/she shall consult the assigned PQAE regarding a HA for the project. This consultation shall determine whether the HA shall be conducted by NETL personnel (for review levels 1 and 2 projects) or externally (for review level 3 projects).

- i. Internal HAs. If the HA is to be conducted internally, the PQAE consultation will also determine the HA method (typically by using DOE Handbook DOE-HDBK-1100-96, as a guide), the HA needs (documents, drawings, etc.), plan a strategy for obtaining the HA needs, and when the HA can take place.
- ii. External HAs. If the HA is to be conducted externally, the consultation will serve as the starting point to begin work on a HA contract.

Whereas external HAs shall be conducted on an individual basis, internal HAs will typically be conducted in a consistent approach. Once the HA needs are met, the EAO DD shall select a facilitator and HA team members, from EAOD or EAOD-appointed personnel, based upon his/her technical experience and knowledge, as well as the project's needs. The OST DD shall also appoint a team member(s) from a pool of OST personnel trained in conducting hazards analyses. The PQAE (or proxy) and RP shall also be HA team members. Once the team has been selected, the facilitator shall schedule the HA. The HA shall be conducted by the team, with the facilitator acting as a guide. A facilitator-appointed scribe shall document HA findings during the HA for inclusion in the HAR. Points of impasse or conflict shall be resolved by the facilitator.

2. Hazards Analysis Report

A HAR shall be generated by the HA facilitator, either internally or externally, and serve as a historical record of the HA. The HAR shall contain a historical section, "HA History," and a findings section "HA Findings." The historical section shall contain information regarding the project and the justification for the chosen HA method. The findings section shall contain a list of specific project associated hazardous conditions, as well as information to help RPs generate HCs. A sample HAR is included on the EAOD webpage.

3. Hazard Charts

- a. Introduction: The intent of HCs is to describe hazardous consequences that may result from linking events and document mitigation method(s) information. HCs serve a secondary purpose to show the status of mitigation measures. HCs shall be generated from the HAR, whether conducted internally or externally.

Additional guidance in completing HCs and a set of sample HCs can be found on the EAOD webpage.

- b. Completing a Hazard Chart: RPs shall use NETL Form 421.1-5 when generating the project's HCs. The RP shall complete the HCs by transferring information from the "HA Findings" section of the HAR, determining mitigation methods, and finally entering the remaining information on the HCs appropriately.
 - i. Mitigation Guide: Mitigation is possibly the most important piece of information given in a hazard chart. The act of mitigation makes the risk(s) associated with a

hazardous consequence acceptable by lowering the associated probability and/ or impact(s). Knowing this, RPs must consider mitigation very carefully.

Mitigation may occur by affecting the hazard, the linking event(s) associated with a hazard, and/or the consequences through engineering controls, administrative controls, safety instrumented systems, and personal protective equipment (either alone or preferably in combination). The preferred hierarchy of mitigation modes is engineering controls, followed by administrative controls, followed by safety integrated systems, followed by PPE.

- ii. Mitigation Time Requirements: Time requirements for mitigations shall be specified in the HA, by the facilitator, with input from the team. Mitigations shall be completed either before issuance of a construction or operations permit, according to the time requirement established in the HA.
 - iii. Mitigation References: Mitigation methods referencing documents such as operating procedures, NETL procedures, etc., shall be specific, i.e., document, page, and section numbers shall be made whenever possible to describe the exact location of referenced material.
- c. Organization of Completed HCs: Mitigation of hazardous consequences resulting from unique linking events shall be addressed in separate HCs, i.e., if the HA reveals the same hazardous consequence can result from two different linking events, then two separate HCs shall be generated to describe mitigation of each linking event. If it is found that a single mitigation method eliminates or reduces the risk of more than one hazardous consequence, then those HCs may be combined.

To aid project personnel with familiarizing themselves with hazardous consequences and associated mitigation measures, HCs shall be separated into three categories:

- Operations
- Proximal
- Shakedown

- d. Assembling the HAR and HCs into the Safety Analysis: The HAR and HCs shall be combined as described in this attachment and placed in the appropriate section of the SA.

ATTACHMENT 5

REVIEW LEVEL RAMIFICATIONS AND DETERMINATION GUIDE

Ramifications of the determined review level are discussed in this attachment. The RP should consult his/her ES&H Representative or PQAE for additional help in determining the review level of his/her safety analysis, or if he/she has questions regarding the ramifications of the review level. A guide to determine the review level of a safety analysis is also provided in this attachment.

1. Safety Analysis Review Level. Each safety analysis shall be assigned a review level of 1, 2, or 3, using this attachment as a guide. The ES&H Representative and PQAE may make recommendations to the OST DD, regarding the review level if they feel the estimate is incorrect. The OST DD shall agree or disagree with the estimate at the time of the quality check.

It is necessary to estimate the review level before the safety analysis is generated because the review level determination will have an impact on the hazard analysis personnel, the safety analysis review, and permit approval authority.

Ramifications of the review level determination are as follows:

- a. The personnel conducting the hazards analysis shall vary.
 - i. Review levels 1 and 2 projects shall undergo hazards analysis by NETL personnel.
 - ii. Review level 3 projects shall undergo an independent hazards analysis.
- b. The parties reviewing the safety analysis shall vary.
 - i. All review level 1 safety analyses shall be reviewed by the ES&H Representative and PQAE.
 - ii. All review levels 2 and 3 safety analyses shall be reviewed by a SARS Package Review Committee.
- c. The OST DD reviews level 1 modifications permits and approves them, at his/her discretion.

2. Review Level Determination Factors

- a. Project Hazards: Unmitigated hazards shall be considered in determining the review level of a safety analysis. At this preliminary stage of the safety analysis, these hazards should be analyzed in a very cursory and global fashion.

- b. **Impact of Project Hazard Consequences:** The review level determination for the safety analysis shall be based on the impact of the worst potential project hazard consequence, i.e., an adverse result of a hazard, and not the probability of the consequence occurring.
3. **Review Level Determination.** To aid RPs in determining the safety analysis review level, a table and flow diagram are included in this attachment. The RP shall use either the table or the flow diagram, based upon his/her preference, to determine the appropriate safety analysis review level of the project.
- a. **Review Level Table:** The table below may be used to make the review level determination for a safety analysis. In the table below, the word “potential” describes the possible extent of damage if the event occurs, not the probability of the event.

Review Level	Significance of Injury or Illness <u>and</u> Significance of Impact Outside of the Project Area
1	Negligible potential for serious injury or illness <u>and</u> negligible impacts outside project area.
2	Potential for serious injury or illness <u>and</u> negligible impacts outside project area.
3	Potential for serious injury, illness, or impacts outside project area.

- b. **Review Level Flow Diagram:** The diagram on the last page of this attachment may be used to make the review level determination for a safety analysis. While following the steps in the diagram, the word “potential” describes the possible extent of damage if the event occurs, not the probability of the event.
4. **Review Level Determination Example.** The following simplified example is provided to depict the decision-making process in determining the safety analysis review level for a project.

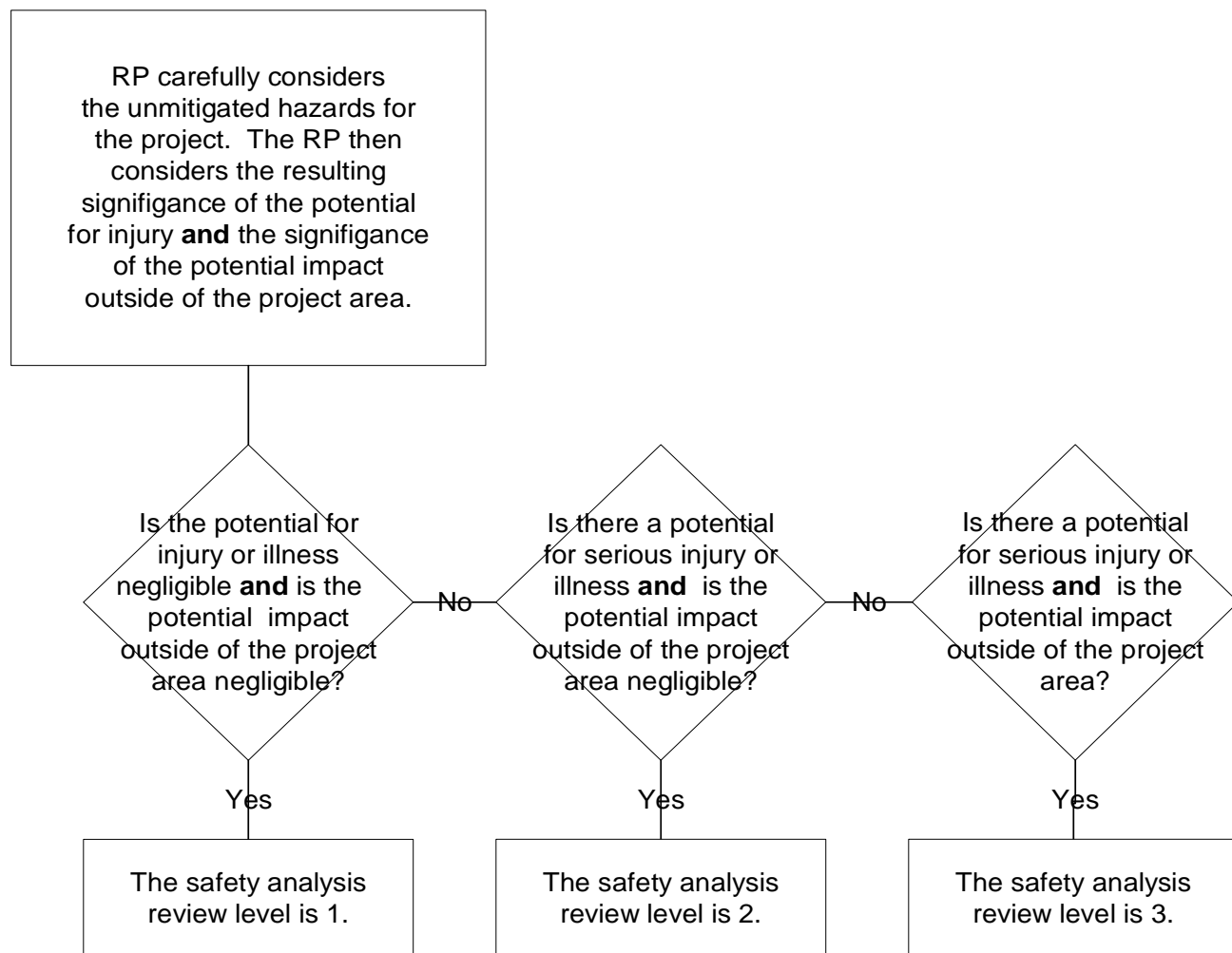
Example:

What would the safety analysis review level for a project be, if its only hazard was a blasting cap?
The review level would be determined by asking the following questions:

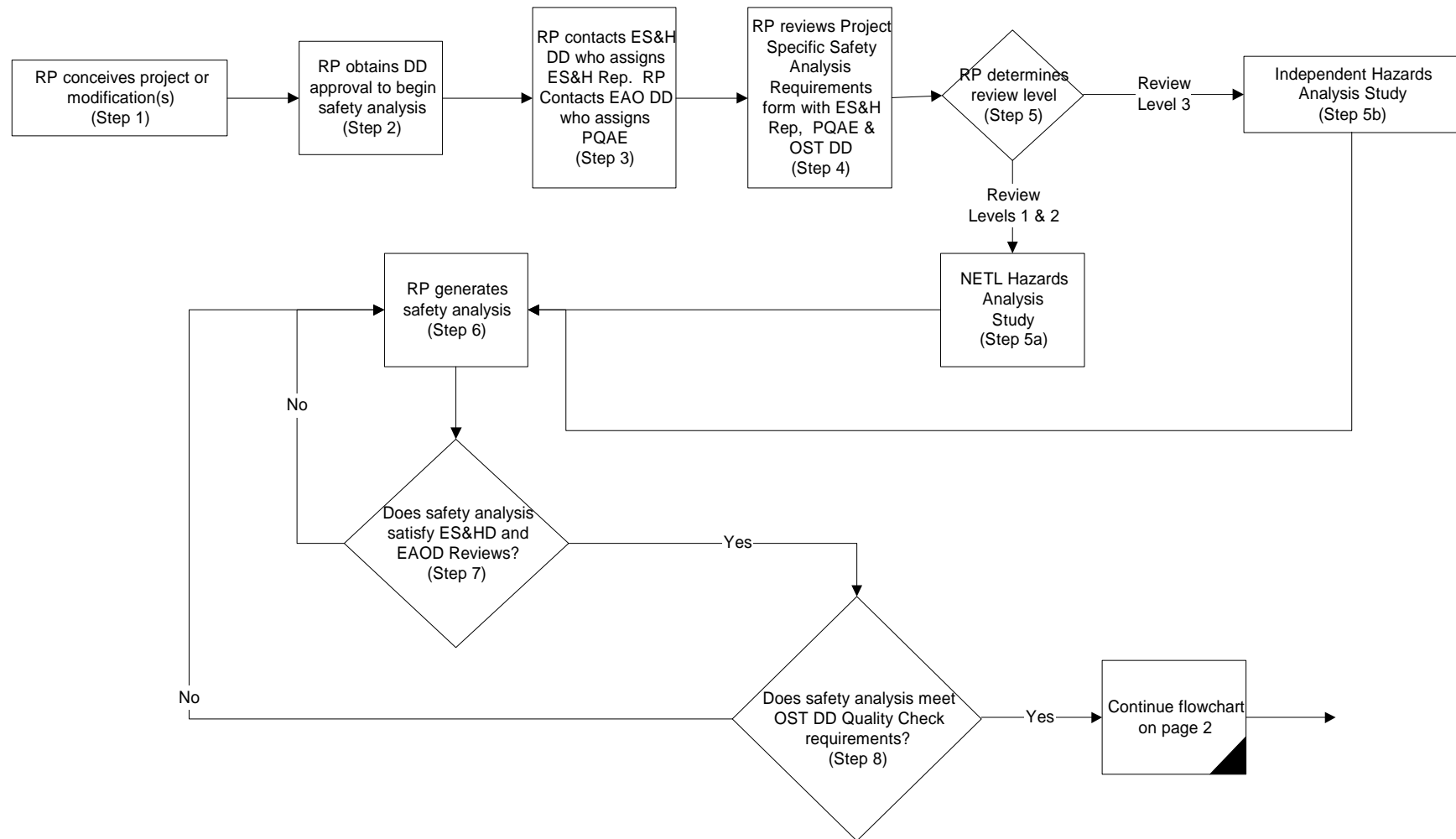
- If the blasting cap detonates, is the potential for serious injury negligible? *Answer: No.* (Which indicates that the safety analysis is not a review level 1.)
- If the blasting cap detonates, is there potential for serious injury? *Answer: Yes.* (Which indicates that the safety analysis will be either a review level 2 or 3.)
- If the blasting cap detonates, is there potential for serious injury, illness, or impact outside of the project? *Answer: No.* (Which indicates that the safety analysis is not a review level 3.)

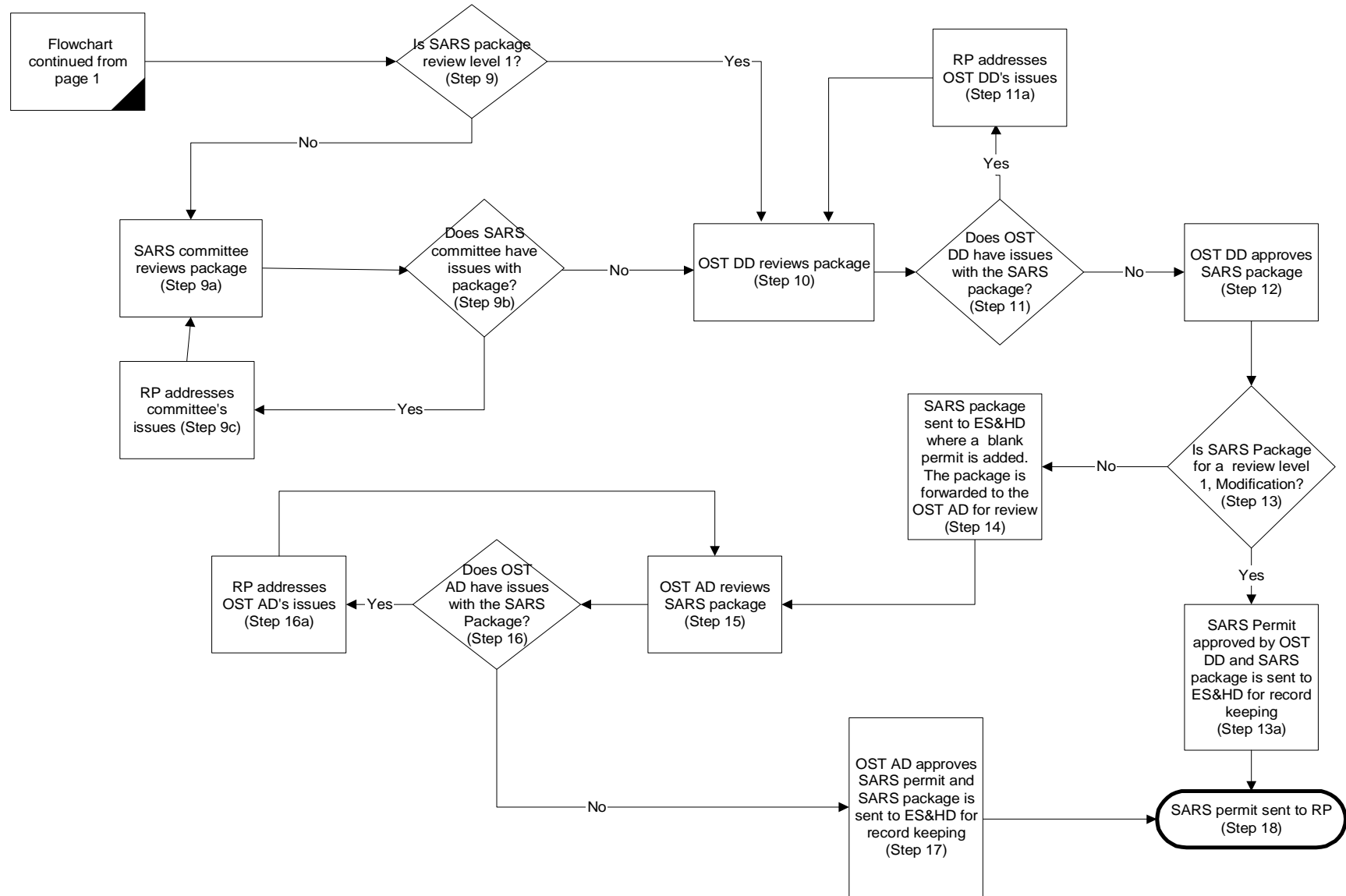
Therefore, the project safety analysis review level would be 2.

Safety Analysis Review Level Determination Flow Diagram



Permitting Process Flow Diagram





ATTACHMENT 7

SHAKEDOWN ACTIVITIES CONTENT REQUIREMENTS

The RP shall describe the shakedown activities for his/her project, as per the requirements given below. This description shall be included in the safety analysis of the project. Specific shakedown activities must be allowed as part of the approved SARS permit, before they may be carried out. If a project will use only the approved operating procedures to conduct shakedown, then a statement to that effect may be used to fulfill the requirements of this attachment.

The content requirements of the shakedown activities description are the same for all types of safety analyses (construction, operations, and modifications) and are as follows:

1. Description of Shakedown Activities: This description shall include a summary of the shakedown activities, the expected shakedown limits (see below), and the basic chemical and physical reactions. Descriptive text should not duplicate detailed information that is shown elsewhere in the safety analysis or on the PFD or P&ID. In most cases, this section should not be more than three pages long.
2. List of specific systems undergoing shakedown.
3. Redlined PFD for Each System: This may be excluded from the construction safety analysis, at the recommendation of the PQAE, with concurrence from the OST DD.
4. Redlined P&ID for Each System: This may be excluded from the construction safety analysis, at the recommendation of the PQAE, with concurrence from the OST DD.
5. Shakedown Envelope: This describes the shakedown limits (e.g., for pressure, temperature, or any other energy form) for the project. The limits should provide maximum and minimum values, whenever possible.
6. Shakedown Procedures: This shall include specific details of shakedown and reference specific system components.
7. External ES&H Permits: If any permits are needed for shakedown activities, then photocopies of those permits shall be included.
8. Unique Construction Hazards: If shakedown will cause unique construction hazardous consequences, this information shall be conveyed to the DOE party responsible for construction safety. Describe the hazards and how the communication was accomplished.